REMARKS

Reconsideration and continued examination of this application, as amended, is respectfully requested. Claims 1-36 are pending in this application.

1. The Invention and the Prior Art Rejections

Claims 1-35 were rejected under 35 U.S.C. § 103(a) as being obvious over U.S. Patent No. 6,611,726 to Crosswhite (Crosswhite) in view of U.S. Patent No. 6,216,154 to Altschuler (Altschuler). It is noted that the present application contains 36 claims, not 35 and it is assumed that claim 36 stands rejected as well. Applicant traverses the rejections because, as explained below, neither Crosswhite nor Altschuler, alone or in combination, teach or suggest the present invention as claimed.

The claims of the present application are directed in one aspect to methods, systems and devices for building or determining the order of a univariate ARIMA model (claims 1, 16, and 20, and all claims dependent thereon) and in another aspect to methods and devices for building or determining the order of a multivariate ARIMA model (claims 8, 24, and 28, and all claims dependent thereon). One purpose of these methods and devices is to identify an ideal or best time series model.

Briefly, Crosswhite and Altschuler bear little relation to the present invention. In fact, both Crosswhite and Altschuler are wholly unconcerned with identifying an ideal time series model.

Crosswhite teaches a method which merely adjusts values of a forecast equation to optimize the error metric in a time series forecasting equation. The method generates a forecast that disregards the accuracy of the next, upcoming time period and instead provides a forecast for a user-selectable future time period. See Crosswhite, col. 5, lines 1-14 and col. 12, lines 25-60. Thus, Crosswhite merely estimates parameters for a GIVEN model based on multi-step ahead, instead of traditional one-step ahead forecasting errors. Crosswhite, however, is not concerned with identifying which forecast model to use as in the claimed present invention. As a result, the claimed present invention has

numerous elements not found in Crosswhite. Such deficiencies, moreover, are not taught or suggested by Altschuler.

Altschuler does not address the problem of identifying time series models either. Altschuler is concerned primarily with how to forecast based upon user inputted dependency hypotheses and combining different forecasts into a global forecast. The dependency hypotheses that are used have to be inputted by the user – they are not found or determined by operation of the computer.

In view of the foregoing, Crosswhite and Altschuler bear little relation to the presently claimed invention. Numerous elements of the independent claims are not taught or suggested by Crosswhite and Altschuler, either alone or in combination with one another as described in detail hereafter. Claims 1-36 are unobvious and patentable and should be allowed.

A. Claims 1-36 are Patentable Because the Combined Use of "Techniques" Such as NBIC, AR, MA, ACF/PACF in the Claimed Invention are not Obvious Over Crosswhite in View of Altschuler

The claims of the present application are patentable because the combined use of "techniques" such as NBIC, AR, MA, ACF/PACF in claims 1-36 are not obvious over Crosswhite in view of Altschuler. Furthermore, nor would the combination of such techniques used in the claimed invention obvious to one skilled in the art. The Examiner admits that Crosswhite does not explicitly describe a square root or logarithmic transformation as recited in claim 1, residuals recited in claims 1, and the use of "techniques" identified by acronyms such as NBIC, AR, MA, ACF/PACF, recited in independent claims 6, 8, 16, 20, 24, 32 and 34. However, the Examiner contends that the analysis of residuals and the modification of the model based on optimum exponential smoothing are well known in the art. Thus, the Examiner concludes it would have been obvious to one of ordinary skill in the art to utilize such "techniques" as general tools without the need to invoke specific designated algorithms. Applicant respectfully disagrees with the Examiner.

First, from Examiner's own admission, Crosswhite does not remotely teach or suggest using such "techniques" in building a univariate and/or

multivariate ARIMA model. Moreover, Altschuler has no teaching or disclosure of such "techniques" in building a univariate and/or multivariate ARIMA model which would fill in the deficiencies of Crosswhite. However, the Examiner contends that the use of such "techniques" in building a model would be obvious to one skilled in the art. Thus, it is apparent the Examiner is rejecting claims 1-36 based on his own judgment of what is within the ordinary skill of one in the art. This is an improper basis for rejecting claims 1-36 of the present application. *In re Zurko,* 258 F.3d 1379, 1385 (Fed. Cir. 2001) ("[T]he deficiencies in the prior art cannot be remedied by the Board's general conclusions about what is 'basic knowledge' or 'common sense' to one of ordinary skill in the art"). Accordingly, Applicant submits for this reason alone claims 1-36 are nonobvious over Crosswhite in view of Altschuler.

However, even *assuming arguendo* for the purpose of this argument only, that such techniques are techniques known to those skilled in the art, the claimed invention does not indiscriminately use known "techniques" in a manner that would have been obvious to one skilled in the art. Creating a univariate ARIMA model that optimally reflects past values in a time series is an extremely convoluted task, even to those skilled in the art. In particular, model identification is one of the most difficult tasks of building a statistical model. Known methods use patterns of ACF to identify autoregression (AR) orders for AR models and PACF to identify moving average (MA) orders for MA models. However, for models where both AR and MA components occur, ACF and PACF identification methods typically fail because there are no clear cut patterns in ACF and PACF. *See* Specification, pages 5-8. The claimed invention selectively identifies non-seasonal AR and MA orders by using ACF, PACF, and EACF patterns while leaving the seasonal AR and MA orders to the model estimation and diagnostic checking stage to modify them. If seasonality is present in the time series, the orders of the seasonal AR and MA polynomials are taken to be 1. *See* Specification, page 19, line 11 to page 20, line 18. Thus, the present invention does not simply use AR and MA orders, but selectively identifies and determines non-seasonal AR and MA orders. Certainly, neither Crosswhite nor Altschuler teach or suggest, alone or in combination, identifying

non-seasonal AR and MA in a model identification process and such a technique would not be obvious to one skilled in the art.

Further, neither Crosswhite nor Altschuler have any teaching or suggestion whatsoever as to modifying the initial ARIMA model based on iterative model estimation results, diagnostic checking and ACF/PACF of residuals. Crosswhite discloses adjusting parameters to lower or optimize an error value but does not teach or suggest modifying an ARIMA model. Altschuler similarly has no teaching whatsoever of an iterative model building process as the method terminates once a global forecast is built. There is further no support for the assertion that one skilled in the art would be motivated to use a combination of ACF and PACF patterns to modify an initial ARIMA model. Accordingly, Applicants submit that claims 1-36 are patentable over Crosswhite in view of Altschuler.

B. Claims 1-5, 16-23 and 32-33, Directed to Methods, Systems and Devices for Building a Univariate ARIMA Model are Nonobvious Over Crosswhite in View of Altschuler

Claims 1-5, 16-23 and 32-33 of the present application, directed to methods, systems, and devices for building a univariate ARIMA model, are nonobvious over Crosswhite in view of Altschuler for the reasons previously described. In particular, as discussed above, claims 1, 16, 20, and 32, and claims dependent thereon, are not obvious over Crosswhite in view of Altschuler because neither reference teaches or suggests, alone or in combination, determining a differencing order for the time series, determining non-seasonal AR and MA orders, constructing an initial ARIMA model based on the differencing order and the AR and MA orders determined earlier, and modifying the initial ARIMA model based on iterative model estimation results, diagnostic checking and ACF/PCF of residuals.

First, the Examiner admits that Crosswhite does not explicitly describe a square root or logarithmic transformation as recited in claim 1, residuals recited in claims 1, and the use of "techniques" identified by acronyms such as AR, MA, in claims 1, 16, 20, and 32 and ACF/PACF as recited in independent claims 1,

16, 20, and 32 but contends that the analysis of residuals and the modification of the model based on optimum exponential smoothing are well known in the art. Accordingly, it is apparent that claims 1-5, 16-23, and 32-33 have been rejected based on the Examiner's own judgment of what is within the ordinary skill of one in the art. This is an improper basis for rejecting claims 1-36 of the present application. *In re Zurko,* 258 F.3d 1379, 1385 (Fed. Cir. 2001) ("[T]he deficiencies in the prior art cannot be remedied by the Board's general conclusions about what is 'basic knowledge' or 'common sense' to one of ordinary skill in the art"). Accordingly, Applicant submits for this reason alone claims 1-5, 16-23, and 32-33 are nonobvious over Crosswhite in view of Altschuler.

However, even *assuming arguendo* for the purpose of this argument only, that such techniques are techniques known to those skilled in the art, the claimed invention does not indiscriminately use known "techniques" such as AR, MA, and ACF/PACF in a manner that would have been obvious to one skilled in the art. As discussed above, the claimed invention does not simply use AR and MA orders, but selectively identifies and determines non-seasonal AR and MA orders. Neither Crosswhite nor Altschuler, alone or in combination, teach or suggest identifying non-seasonal AR and MA orders in a model identification process and such a technique would not be obvious to one skilled in the art.

Moreover, neither Crosswhite nor Altschuler have any teaching or suggestion whatsoever as to modifying the initial ARIMA model based on iterative model estimation results, diagnostic checking and ACF/PACF of residuals. Crosswhite discloses adjusting parameters to lower or optimize an error value but does not teach or suggest modifying an ARIMA model. Altschuler similarly has no teaching whatsoever of an iterative model building process as the method terminates once a global forecast is built. There is further no support for the assertion that one skilled in the art would be motivated to use a combination of ACF and PACF patterns to identify non-seasonal AR and MA to modify an initial ARIMA model. Accordingly, Applicants submit that claims 1, 16, 20, and 32, and all claims dependent thereon are patentable over Crosswhite in view of Altschuler.

Further, Crosswhite or Altschuler do not disclose or suggest transforming a time series comprised of positive separate data values and any positive inputted values as required in claims 1-7, 16-23 and 32-33. Crosswhite teaches a method wherein historical data is gathered, scrubbed if necessary, and then the data is used to produce a forecast. In producing the forecast, initial parameters are set and an error metric is set for optimization. A forecast is created and the error resulting from the forecasting equation is determined, the error being equal to the difference between the estimated forecast and the historical data for a selected period. The forecasting equations are then modified to minimize the error statistic such that the estimated forecast for a selected future period is optimized. In particular, the error calculation "preferably utilizes the absolute value of the errors or the squared values of the errors." *See* Crosswhite, col. 5, lines 29-41. Thus, Crosswhite discloses taking the absolute value of the error between the historical data and forecasted data, but does not teach or suggest transforming a time series comprised of positive separate data values and any positive inputted values. Altschuler is wholly silent as to determining transforming the time series comprised of positive separate data values and any positive inputted values. Accordingly, for this reason alone, claims 1, 16, and 20, and all claims dependent thereon, are not obvious over Crosswhite in view of Altschuler.

Even further, neither Crosswhite nor Altschuler, alone or in combination teach or suggest determining whether inputted separate data values and any other imputed data values of a time series are positive numbers.

C. Claims 6-7 Directed to a Method for Determining the Most Optimum Univariate Model between the Optimum Exponential Smoothing Method and the Optimum ARIMA Model is Nonobvious Over Crosswhite in View of Altschuler

The Examiner additionally rejected claims 6-7 over Crosswhite in view of Altschuler. Claim 6 is directed to a method for determining the most optimum univariate model between the optimum exponential smoothing model and the optimum ARIMA model comprising calculating an NBIC value for each of the optimum smoothing model and the ARIMA model and selecting, as the most

optimum variable univariate model, one of the optimum exponential smoothing model and the ARIMA model with the smallest NBIC.

First, Altschuler clearly teaches away from selecting a optimum univariate model from a group of models which include ARIMA models. Teaching away is a *per se* demonstration of a lack of prima facie obviousness. *In re Dow Chemical,* 837 F.2d 469 (Fed. Cir. 1988). A reference may be said to teach away when a person of ordinary skill, upon reading the reference, would be led in a direction divergent from the path that was taken by the applicant. *Tec Air, Inc., v. Denso Mfg. Mich. Inc.,* 192 F.3d 1353, 1360 (Fed. Cir. 1999). Altschuler discloses a tool for forecasting events that are not time-homogeneous. As such, Altschuler discloses that ARIMA models are particularly unsuitable for its invention. *See* On Altschuler, col. 2, lines 13-21. "Unfortunately, however, a fundamental assumption of the ARIMA model makes it unsuitable for non-homogeneous time intervals." Thus, upon a reading of Altschuler, one would clearly be led in a direction away from selecting an optimum univariate model selecting from a group which consisted of ARIMA models from a reading of Altschuler. Accordingly, Applicant submits for the above reasons alone claims 6-7 are not obvious over Crosswhite in view of Altschuler.

Further, as discussed above, the Examiner admits that Crosswhite does not explicitly describe the use of "techniques" identified by acronyms such as NBIC required in claim 6. The Examiner contends that the analysis of residuals and the modification of the model based on optimum exponential smoothing are well known in the art. Thus, the Examiner concludes it would have been obvious to one of ordinary skill in the art to utilize such "techniques" as general tools without the need to invoke specific designated algorithms. Applicant respectfully disagrees with the Examiner's position. Neither Crosswhite nor Altschuler teach or suggest choosing an optimum univariate model based on the model having the lowest NBIC. Moreover, such a rejection is improper because it is based on the Examiner's own judgment of what is within the ordinary skill of one in the art. This is an improper basis for rejecting claims 6-7 of the present application. *In re Zurko,* 258 F.3d 1379, 1385 (Fed. Cir. 2001) ("[T]he deficiencies in the prior art cannot be remedied by the Board's general conclusions about what is 'basic

knowledge' or 'common sense' to one of ordinary skill in the art"). Accordingly, Applicant further submits claims 6-7 are nonobvious over Crosswhite in view of Altschuler.

D. Claims 8-15, 24-31 and 34-36, Directed to Methods and Systems for Building a Multivariate ARIMA Model are Nonobvious Over Crosswhite in View of Altschuler

The Examiner additionally rejected claims 8-15, 24-31 and 34-35, directed to a computer system and method for building a statistical model based on a multivariate time series. Multivariate models include a disturbance series which may influence a time series to be forecasted. The claimed invention specifies inputting a time series and also inputting at least one category consisting of predictors, interventions and events represented by numerical values. Thereafter, the positive inputted categories are transformed using the same transformation applied on the time series inputted and differenced using the same differencing orders applied on the time series inputted. In other words, the AR and MA orders found for the inputted time series through determining the ARIMA order for the inputted time series is used for the disturbance series in the initial multivariate ARIMA model.

Claims 8-15, 24-31, and 34-35, directed to building a multivariate ARIMA model, are nonobvious over Crosswhite in view of Altschuler for the following reasons in addition to those previously described. Further, neither Crosswhite nor Altschuler, alone or in combination, teach or suggest inputting at least one category of predictors interventions, and events represented by numerical values and determining whether input categories have one or missing values and discarding the categories having any missing values as required in claims 8, 24, 28, and 34 and all claims dependent thereon. Crosswhite has no disclosure whatsoever of inputting predictors, interventions, and events and further only discloses a "scrubbing" step where "missing data values must be filled in as part of the data scrubbing step." The scrubbing step may include filling in a value of zero, using a forecasting approach to estimate a replacement value, filling in the

missing data with the average of data values surrounding the missing data point, and fitting a curve through the existing data and interpolating inside the curve to arrive at replacement values. *See* Crosswhite, col. 9, lines 39-62. None of these steps describe discarding categories having missing values as in the claimed invention.

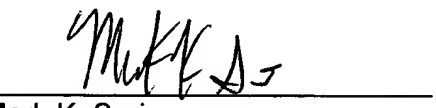
Altschuler has no disclosure whatsoever of determining whether the input categories have one or missing values and discarding the categories having any missing values. Altschuler merely teaches determining the correlation of groups of similar dependence hypotheses to known data, determining the weight of the correlation, and creating a global forecast. *See* Claim 13 of Altschuler, for example. Accordingly, Applicants submit for this reason alone, claims 8, 24, 28, and 34, and all claims dependent thereon, are nonobvious over Crosswhite in view of Altschuler.

Additionally, claims 8-15, 24-31 and 34-36, directed to building a multivariate ARIMA model, are nonobvious over Crosswhite in view of Altschuler because neither Crosswhite nor Altschuler teach or suggest differencing and transforming a time series and using the same transformation and differencing orders on inputted categories consisting of predictors, interventions, and events. Crosswhite merely discloses modifying the parameters of a single forecasting equation such that an error metric is reduced for a user selected time period. Altschuler teaches determining the correlation of groups of similar dependence hypotheses to known data, determining the weight of the correlation, forecasting an unknown value based on group of similar dependence hypotheses and known data, and determining a global forecast based on group forecasts and weights. *See* Altschuler, FIG. 6. Moreover, neither Crosswhite nor Altshuler teach or suggest constructing an initial ARIMA model for the time series based on a univariate ARIMA found for the time series, the interventions and events, and remaining categories.

CONCLUSION

In view of the foregoing, claims 1-36 are allowable. An indication of allowance is solicited at an early date.

Respectfully submitted,



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Dated: July 2, 2004

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